Table 1. Chemical Compositions of Alloys

Alloy	Al %	Mn %	Zn %	Ca %	Sr %	RE %	Si %	Fe %	Ni %	Cu %	Be %	Zr %
Example1	4.8	0.26	0.15	0.25	1.35	0.08	0.01	0.003	0.0007	0.0005	0.0003	-
Example2	5.3	0.30	0.10	0.20	0.80	0.10	0.01	0.003	0.0006	0.0014	0.0004	-
Example3	6.1	0.25	0.40	0.20	0.90	0.20	0.01	0.003	0.0002	0.0012	0.0003	-
Example4	5.3	0.30	0.35	0.22	1.18	0.49	0.01	0.001	0.0005	0.0011	-	-
Example5	7.0	0.32	0.14	0.53	0.46	0.15	0.01	0.001	0.0008	0.0011	-	-
Example6	6.9	0.28	0.62	0.52	0.48	0.18	0.01	0.001	0.0007	0.0008	0.0004	-
Example7	7.9	0.12	0.12	0.66	0.52	0.12	0.01	0.001	0.0009	0.0011		0.01
Example8	7.9	0.31	0.64	0.68	0.55	0.16	0.01	0.002	0.0008	0.0016	-	-
Example9	8.8	0.24	0.11	0.85	0.51	0.03	0.01	0.001	0.0009	0.0014	-	-
Example10	8.5	0.28	0.72	0.95	0.25	0.08	0.01	0.002	0.0008	0.0017	-	
Example11	8.7	0.07	0.15	0.85	0.15	0.24	0.01	0.001	0.0009	0.0012	-	0.01
Example12	8.9	0.18	0.48	0.65	0.05	0.75	0.01	0.002	0.0010	0.0009	0.0003	
Example13	8.4	0.22	0.05	1.05	0.28	0.05	0.01	0.001	0.0008	0.0011	-	
Example14	9.1	0.22	0.60	0.80	0.55	0.06	0.01	0.001	0.0008	0.0021	-?	
Comparative Example1	8.9	0.23	0.74	-	-	-	0.01	0.003	0.0007	0.0009	0.0009	
Comparative Example2	4.3	0.29	0.01	-	-	2.4	0.01	0.003	0.0008	0.0008	0.0008	
Comparative Example3	4.4	0.31	0.05	1.4	0.1	0.25	0.01	0.003	0.0006	0.0011	0.0009	
Comparative Example4	9.4	0.19	0.54	1.3	0.45	0.05	0.01	0.002	0.0008	0.0012	0.0007	
Comparative Example5	8.1	0.24	0.15	0.8	0.85	0.12	0.01	0.003	0.0009	0.0015	0.0004	

Fig. 1

Table 2. Intermetallic Phases in New Alloys

Alloy	Phase Composition
Example 1	Mg-Al_{ss}, Al_2 (Sr, Ca)$_1$, Al_x (Mn, RE)$_y$
Example 2	Mg-Al_{ss}, Al_2 (Sr,Ca)$_1$, Al_x (Mn,RE)$_y$
Example 3	Mg-Al_{ss}, Al_2 (Sr,Ca)$_1$, Al_y (Mn,RE)$_y$
Example 4	Mg-Al_{ss}, Al_2 (Sr,Ca)$_1$, Al_2 (Sr,Ca,RE$_1$), Al_y (Mn,RE)$_y$
Example 5	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr)$_{12}$, Al_2 $Ca_{0.5}$ $Sr_{0.5}$, Al_8 (Mn,RE)$_5$
Example 6	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr,Zn)$_{12}$, Al_8 (Mn,RE)$_5$, (Al, Zn)$_2$ $Ca_{0.5}$ $Sr_{0.5}$
Example 7	Mg-Al_{ss}, Mg_{17} Al_9 Ca_9 Sr, Al_2 $Ca_{0.5}$ $Sr_{0.5}$, Al_8 (Mn,RE)$_5$
Example 8	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr,Zn)$_{12}$, Al_8 (Mn,RE)$_5$, (Al, Zn)$_2$ $Ca_{0.5}$ $Sr_{0.5}$
Example 9	Mg-Al_{ss}, Mg_{17} Al_9 Ca_2 Sr, Al_2 $Ca_{0.5}$ $Sr_{0.5}$, Al_8 (Mn,RE)$_5$
Example 10	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr,Zn)$_{12}$, Al_8 (Mn,RE)$_5$, (Al, Zn)$_2$ $Ca_{0.8}$ $Sr_{0.2}$
Example 11	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr)$_{12}$, Al_2 $Ca_{0.8}$ $Sr_{0.2}$, Al_8 (Mn,RE)$_5$
Example 12	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr,Zn)$_{12}$, Al_2 (Ca,RE)$_2$, Al_8 (Mn,RE)$_5$
Example 13	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr,Zn)$_{12}$, Al_8 (Mn,RE)$_5$, (Al, Zn)$_2$ (Ca, Sr)$_1$
Example 14	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr,Zn)$_{12}$, Al_8 (Mn,RE)$_5$, (Al, Zn)$_2$ $Ca_{0.5}$ $Sr_{0.5}$
Comparative example 1	Mg-Al_{ss}, Mg_{17}(Al,Zn)$_{12}$, Al_8Mn_5
Comparative example 2	Mg-Al_{ss}, Al_{11} RE_3, Al_{10} RE_2 Mn_7
Comparative example 3	Mg-Al_{ss}, Al_2 (Ca,Sr)$_1$, Al_y (Mn,RE)$_y$
Comparative example 4	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr,Zn)$_{12}$, Al_8 (Mn,RE)$_5$, (Al, Zn)$_2$ (Ca, Sr)$_1$
Comparative example 5	Mg-Al_{ss}, Mg_{17} (Al,Ca,Sr)$_{12}$, Al_2 (Ca,Sr)$_1$, Al_8 (Mn,RE)$_5$

Fig. 2

Table 3. Die Castability Properties

Alloy	Casting temperature [°C]	Oxidation Resistance	Fluidity	Die Sticking	Rank
Example 1	690	9.5	9	8.5	88
Example 2	690	9.5	9	9	91
Example 3	680	10	10	9.5	96
Example 4	690	9.5	9	9	92
Example 5	680	10	10	10	100
Example 6	660	10	8.5	9	91
Example 7	670	10	10	10	100
Example 8	660	10	9	9.5	95
Example 9	670	10	10	10	100
Example 10	680	10	10	9	93
Example 11	670	10	10	9.5	97
Example 12	670	10	10	9	93
Example 13	670	10	10	9	90
Example 14	660	10	9	9	92
Comparative Example 1	670	9.5	10	10	99
Comparative Example 2	690	8	8	9	80
Comparative Example 3	700	8	8	6	67
Comparative Example 4	670	10	10	7	80
Comparative Example 5	660	10	10	7	80

Fig. 3

Table 4. Mechanical Properties and Creep Behavior

Alloy	TYS [MPa]		UTS [MPa]	E%	CYS [MPa]		MCR . 10^9 [S^{-1}]		CR mg/cm^2/day
	20°C	150°C	20°C	20°C	20°C	150°C	135°C 85 MPa	150°C 50 MPa	
Example 1	145	112	250	10	144	112	1.8	1.1	1.48
Example 2	145	108	244	10	147	105	1.9	1.2	1.45
Example 3	153	116	249	9	152	118	13.6	3.2	1.40
Example 4	153	130	253	8	155	132	1.4	1.1	0.86
Example 5	166	135	275	10	167	130	4.8	1.1	1.24
Example 6	164	125	272	8	165	125	5.9	1.8	1.27
Example 7	172	140	275	8	171	138	7.1	1.5	1.01
Example 8	175	130	272	6	174	130	8.6	2.2	1.12
Example 9	178	142	262	5	178	140	6.9	1.8	0.93
Example 10	175	120	260	5	174	122	11.8	2.7	1.21
Example 11	174	121	259	5	174	122	9.4	2.5	0.98
Example 12	164	115	252	6	166	112	12.1	2.9	1.08
Example 13	178	135	260	4	177	122	7.2	1.9	0.95
Example 14	182	122	266	4	181	138	11.5	2.5	1.03
Comparative Example 1	160	105	260	6	160	105	305	61	1.31
Comparative Example 2	135	100	240	12	135	100	12.4	2.2	1.62
Comparative Example 3	143	108	235	8	142	108	7.8	2.2	1.56
Comparative Example 4	182	138	238	1	181	137	12.2	2.3	1.41
Comparative Example 5	180	141	232	1	179	142	8.3	2.1	1.43

Fig. 4

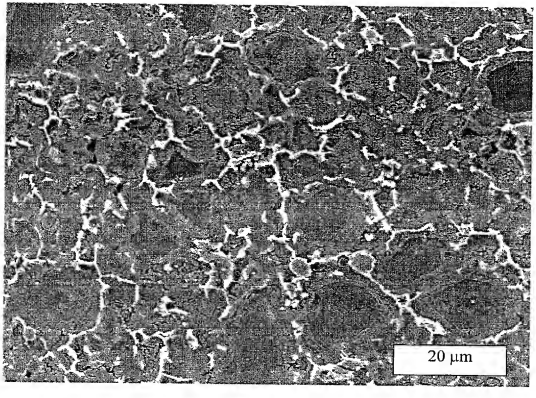

Fig. 5A

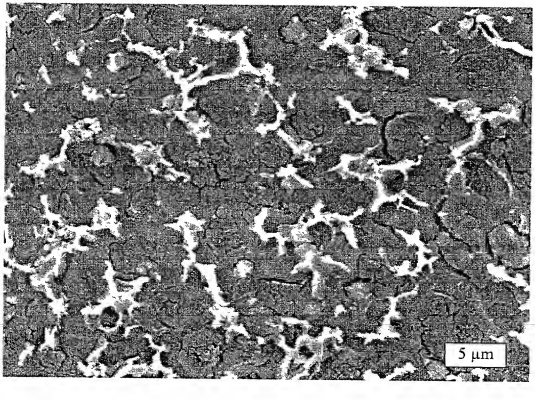

Fig. 5B

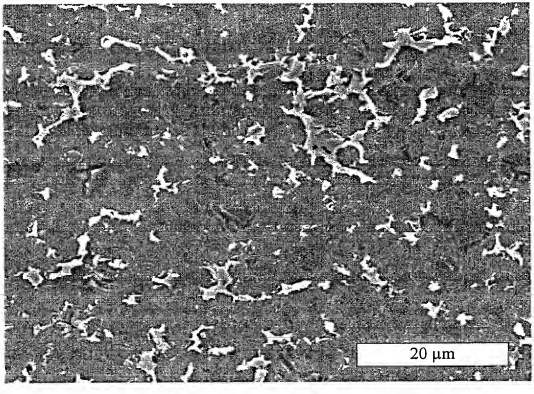

Fig. 6A

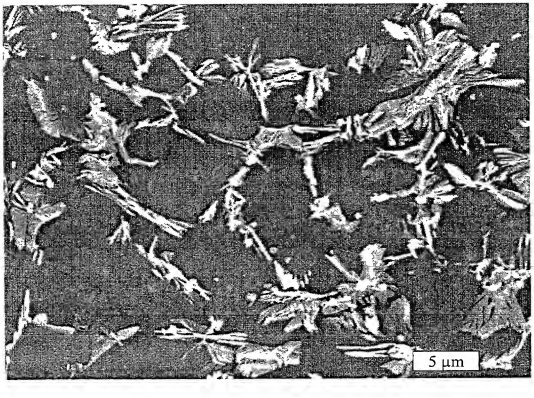

Fig. 6B